PESTS NOT KNOWN TO OCCUR IN THE UNITED STATES OR OF LIMITED DISTRIBUTION, NO. 15: CITRUS BLACKFLY

Prepared by USDA, APHIS, PPQ, Biological Assessment Support Staff, Federal Building Room 626, Hyattsville, MD 20782

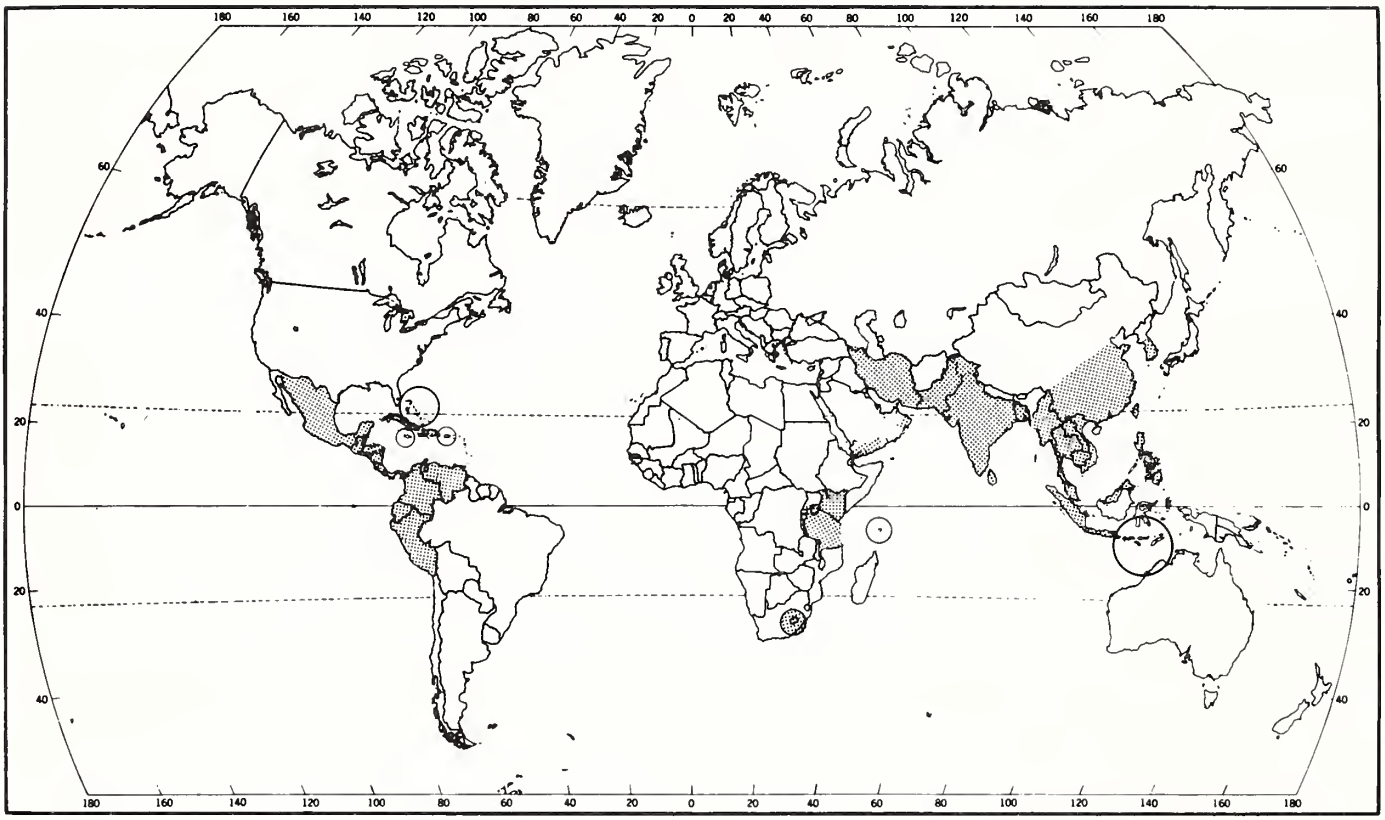
Order: Family — Homoptera: Aleyrodidae

Pest — CITRUS BLACKFLY
Aleurocanthus woglumi Ashby

Economic Importance — *A. woglumi* is considered the most injurious insect infesting citrus trees. It can reduce a citrus tree to nonproductivity more quickly than any other known citrus pest. A 2-year uncontrolled infestation has been known to result in complete crop failure. In Mexico, there is almost a complete crop failure when heavy infestations on citrus trees last longer than a year. Infestations of shorter duration may reduce production as much as 50 percent, as well as depreciate fruit quality. In general, growers report about 80 percent production loss in areas of heavy infestation (Smith and Maltby 1964). Although the parasite program is apparently a success in Florida, the spread of this pest to Arizona and California citrus areas is still of concern (see natural enemies section).

Hosts — Immature forms of *A. woglumi* have been found on about 155 species of plants. A recent study by Steinberg and Dowell (1980) showed that the infestation of some of these other hosts may depend on the presence of nearby infested citrus. The most important hosts of the rutaceous plants are *Atalantia spinosa* (atalantia), *Citrus aurantiifolia* (lime), *C. aurantium* (sour orange), *C. grandis* (shaddock), *C. limon* (lemon), *C. medica* (citron), *C. reticulata* (mandarin and tangerine), *C. paradisi* (grapefruit), *C. sinensis* (sweet orange), *Fortunella* sp. (kumquat), *Severinia buxifolia* (Chinese box orange), *Swinglea glutinosa* (tabog), and *Triphasia trifolia* (limeberry); and the nonrutaceous plants: *Annona cherimola* (cherimoya), *Coffea arabica* (coffee), *Cydonia oblonga* (quince), *Diospyros* sp. (persimmon), *D. ebenum* (ebony), *D. kaki* (Japanese persimmon), *Myrtus communis* (myrtle), and *Pyrus communis* (pear). In the United States, citrus and mango were considered preferred hosts during the Key West, Florida, (see distribution) infestation (Shaw 1950).

General Distribution — *A. woglumi*, a native of India, occurs in Asia: Bangladesh Burma, Cambodia, China, Indonesia (Java and Sumatra), Iran, Korea, Laos, Malaysia, Oman, Pakistan, Philippines, South Yemen, Sri Lanka, Taiwan, Thailand, and Vietnam;



Aleurocanthus woglumi map prepared by USDA, APHIS, PPQ, Biological Assessment Support Staff

and in Africa: Kenya, Seychelles, South Africa (first recorded in 1959), and Tanzania. It was first discovered in the New World in Jamaica in 1913, and the infestation has spread to the West Indies: The Bahamas, Cuba, and Haiti; Mexico (first recorded in 1935); Central America: Costa Rica, El Salvador, Guatemala, Nicaragua, and Panama; and South America: Colombia, Ecuador, Peru, and Venezuela (first recorded in 1965) (Commonwealth Institute of Entomology 1976).

In the United States, A. woglumi was found and eradicated in Key West, Florida, in 1934-37 and in Brownsville, Texas, in 1955-56 (Smith and Maltby 1964). Reintroduction and establishment occurred in Florida in 1976 and Texas in 1971 (U.S. Department of Agriculture 1976 and 1971).

Characters

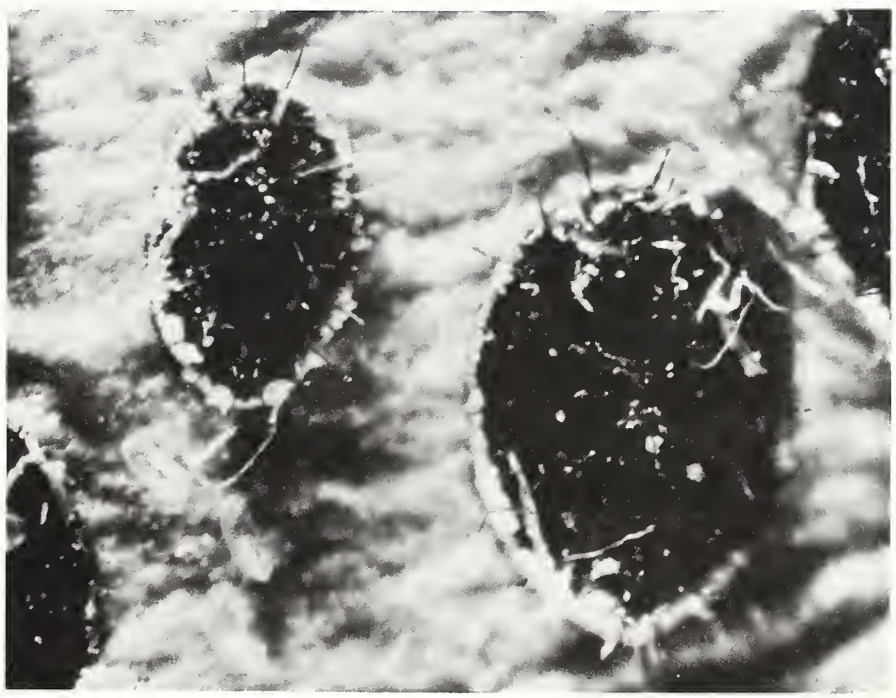
ADULTS - Female 1.66 mm and male 1.33 mm long, head and thorax brick red, frontal head pale yellow, eyes reddish brown, antennae and legs whitish, forewings 1.268 mm long and 0.76 mm wide at the widest part, slate blue wings, colorless spots on wings form what appears as white band across middle of dorsum when at rest.

EGGS - Creamy whitish when first laid, become black in 8-10 days, oblong with round ends.

LARVAE - Length and width vary from 0.300 by 0.150 mm (first instar) to 0.870 by 0.740 mm (third instar), convex, body shiny black and spiny with hemispherical dull green spot on anterior part of abdomen.

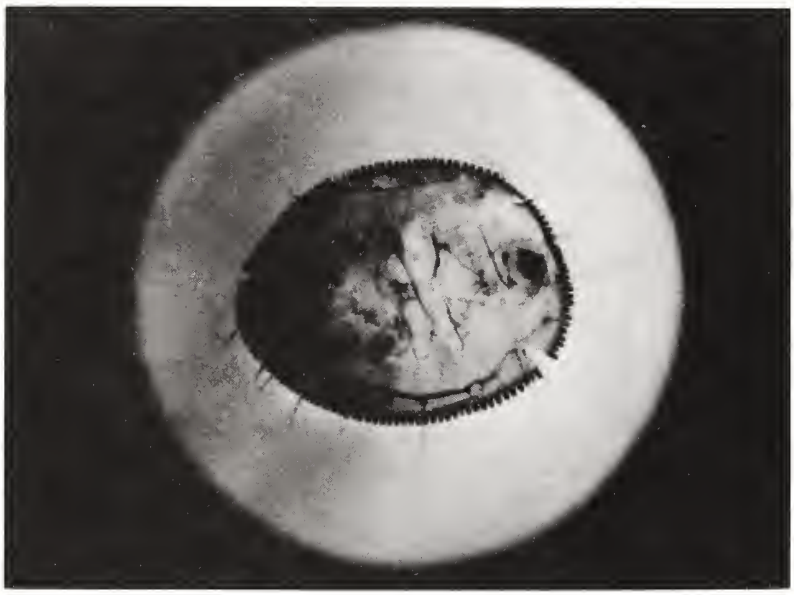
PUPAE - Females larger than males, size of case 1.4 by 0.89 mm, length about 1 mm, convex, oval, black, with a marginal band of white waxy secretion (fig. A). Pupa case with 16-26 spines form the submarginal ring, submarginal spines long and prominent, extend beyond the margin of case. Teeth of margin very large and rounded (fig. B), 6 or 7 teeth per 0.1 mm (Quaintance and Baker 1917, Weems 1962).

(Fig. A)



A. woglumi: Pupa with marginal band of white waxy secretion

(Fig. B)



A. woglumi: Slide mount showing marginal teeth, submarginal spines

A. woglumi and Aleurocanthus spiniferus (see article #14 in this series) are difficult to distinguish (see detection notes). In summary the differences are: The pupae of the latter have narrower marginal teeth, and the size and arrangement of the spines differ, those of A. woglumi being the larger; the color and pattern of the wings of the adults also are distinctive (Weems 1974, U.S. Department of Agriculture 1959, Kuwana 1928, Quaintance and Baker 1917).

Characteristic Damage

This species excretes honeydew that falls on the leaves, causing the growth of a sooty mold which interferes with the normal function of the leaves, reducing respiration and photosynthesis. During heavy infestations, the sooty mold also occurs on the fruit, lowering its quality. Continual heavy infestation leads to tree mortality.

Detection Notes

1. Inspect for spiral egg masses and larvae on underside of leaves (fig. C). The larvae of this species resemble A. spiniferus but the arrangement of the spines differ. A. woglumi is indistinguishable from A. spiniferus in the field.

2. Detection can be done any time of the year, but adults would not be found during the winter.

3. Watch for honeydew, sooty mold on leaves and fruit, and ant trails.

4. The dark, smoky-colored adult may be found periodically, assembled on tender terminal growth (Allen 1971, personal communication).

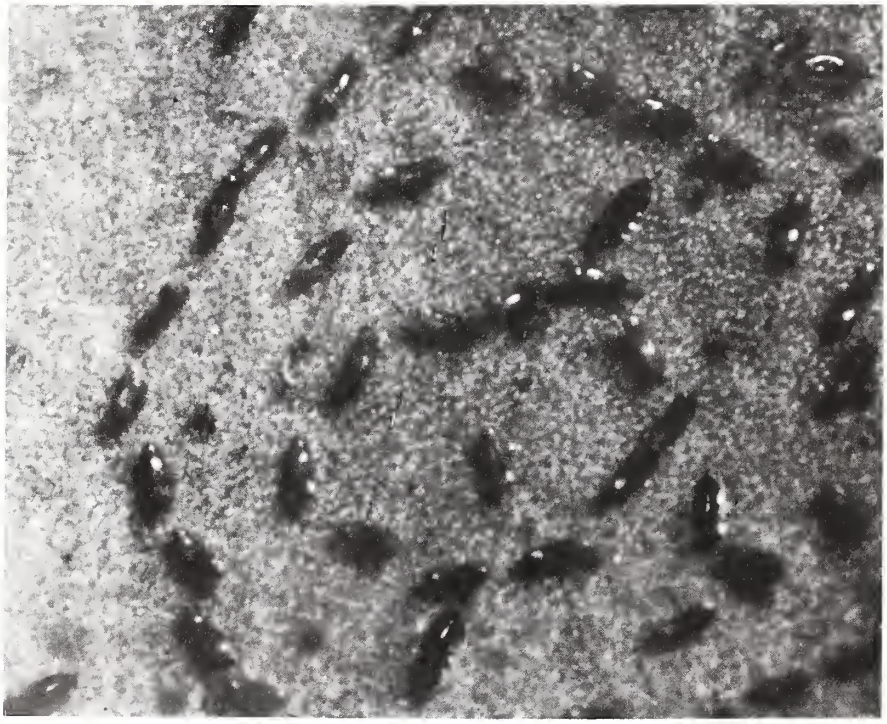
(Fig. C)

A. woglumi: Egg masses and larvae on underside of leaf

Biology

Eggs are laid on the underside of leaves; about 35-50 eggs per spiral or mass (fig. D). Females lay up to 100 eggs or more during their life span of about 10 days (fig. E). The eggs are attached to the leaf by a short pedicel near the posterior end of the egg. They hatch in about 15 days (7-25 depending on temperature). The temperature limits are -5° and 45°C. The first instar larvae are mobile for 3-5 hours before selecting a permanent feeding site. They have been known to crawl as far as 38 mm from the egg spiral, which is more than enough to spread to other touching plants.

(Fig. D)



A. woglumi: Eggs per spiral

(Fig. E)

A. woglumi: Adult female depositing eggs on host leaf

In a trapping study, Meyerdirk et al. (1979) found that A. woglumi has a diurnal flight pattern stimulated by dawn. Males dominated the morning flights, females the afternoon flights. The optimal height for traps in number caught was 1.5 m in a tree canopy of 3-4 m.

The first larval stage lasts 8-17 days, the second lasts 7-16 days, and the third lasts 7-22 days. The pupal stage lasts 21-45 days (Smith and Maltby 1964). There are 2-6 generations per year, depending on the climate. Development is more rapid on succulent foliage under conditions of almost constant humidity. In Mexico, the life cycle is completed in 2-4 months (Cherry 1979, Dowell et al. 1978).

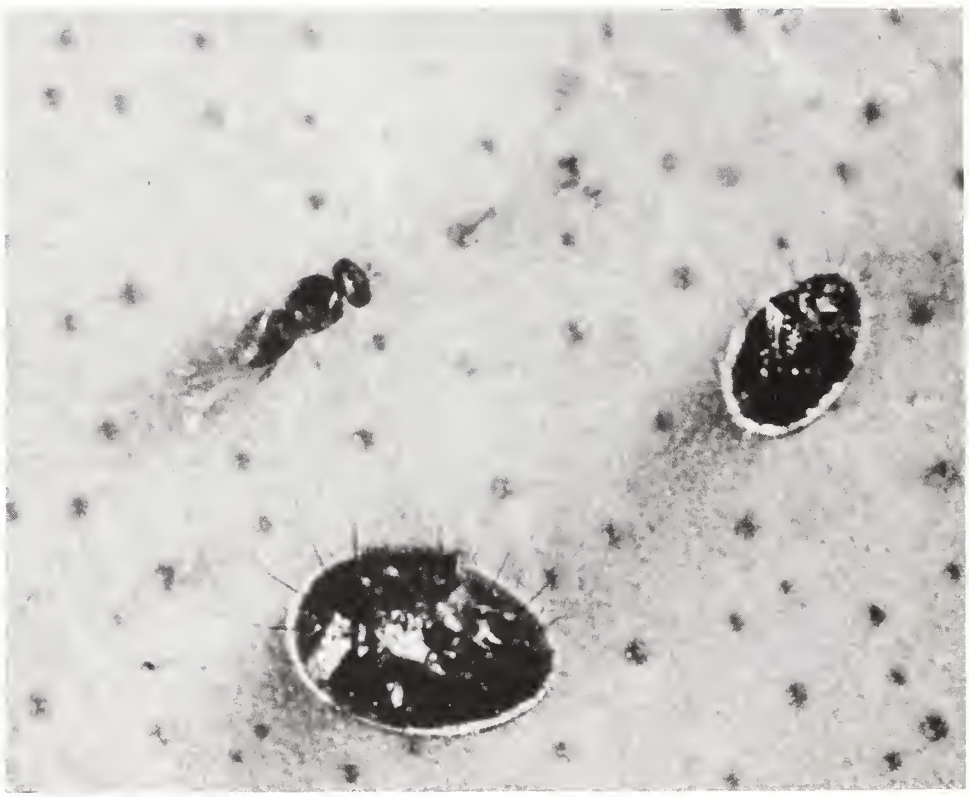
Natural Enemies

To combat the 1976 Florida infestation, Amitus hesperidum Silvestri and Prospaltella opulenta Silvestri were sent from the USDA Citrus Insects Laboratory, which had several species in culture in Mexico, to the Fort Lauderdale area. Establishment and dispersal were immediately successful (Selhime 1979).

A study by Dowell (1979) found that A. hesperidum oviposits in the first two instars of its host and emerges from the fourth. The parasite is well synchronized as measured in thermal units for development with its host. The 29 percent rate of parasitization of the 4th instar was the most important factor among all those that cause larval mortality, such as predators (a lady bird beetle Delphastus pusillus LeConte and Chrysopa spp.), wind, and desiccation. Without predators or parasites present a 23-fold population increase would be expected, with predators a 5-fold increase, and with predators and parasites a 5-fold decrease.

Adults of A. hesperidum live 2 days without food or water, 3-6 days under favorable conditions. Temperature limits are 10-45°C, matching well with those of its host. The short life span, temporal synchronization, and mature eggs at eclosion allow A. hesperidum to parasitize quickly a great number of hosts, if available. Densities in southern Florida were reduced from 60 to 1 immature host per leaf in 1 year's time, November 1976 to September 1977. In the past, the large reduction of populations was reversed again shortly afterward. Complete control depends on establishment of Prospaltella spp., which are much slower in development but also more lasting in effectiveness, being able to act upon very low host population levels (Cherry and Pastor 1980, Cherry 1979, Dowell 1979).

(Fig. F)



Adult of Amitis hesperidum and its host, A. woglumi pupae

For the above reasons, P. opulenta, brought from Mexico to El Salvador to successfully control A. woglumi (Quezada 1974), was introduced in Florida with A. hesperidum. This combination quickly reduced A. woglumi populations to noneconomical levels. Pesticide applications have been discontinued, saving State and Federal governments about $4 million annually (Lee 1979, Selhime 1979).

Despite the success of the biological control program, there remained the feeling in Florida, especially from industry, that complete eradication of this pest was cheaper than raising and distributing parasites. There was also the uneasiness as to whether the program would remain as successful should A. woglumi reach the commercial citrus areas. In 1979, successful eradication was estimated to be a 5-year effort at a cost of $5 million annually, as opposed to $1 million annually for the biocontrol program. The program will continue to be reviewed by industry and State scientific regulatory agencies. Trapping methods have been developed for this purpose (Anonymous 1979, Dowell and Cherry 1981).

Listed below are the various other natural enemies which have been found to attack A. woglumi throughout subtropical and tropical Asia (Clausen 1934).

Eulophid wasp parasites: Encarsia merceti Silvestri, Eretmocerus serius Silvestri, Prospaltella divergens Silvestri, Prospaltella smithi Silvestri, and Prospaltella sp.

Predators: Acletoxenus indica Malloch and Acletoxenus sp. nov., drosophilid flies; Chrysopa sp., a green lacewing; Cryptoblabes gnidiella Milliere, a pyralid moth; Cybocephalus sp., a sap beetle; Cryptognatha sp., Scymnus smithianus Silvestri, Scymnus sp., and Scymnus sp. near pallidicollis Mulsant, lady beetles (Hart et al. 1978).

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